Name: ______________________ Date: ______________

Polynomial Operations SOLUTION (version 141)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -2x^5 - 10x^4 + 4x^2 + 5x + 7$$

$$q(x) = -6x^5 - 2x^3 + 3x^2 + x + 9$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-2)x^5 + (-10)x^4 + (0)x^3 + (4)x^2 + (5)x^1 + (7)x^0 \\ q(x) &= (-6)x^5 + (0)x^4 + (-2)x^3 + (3)x^2 + (1)x^1 + (9)x^0 \\ q(x) - p(x) &= (-4)x^5 + (10)x^4 + (-2)x^3 + (-1)x^2 + (-4)x^1 + (2)x^0 \\ q(x) - p(x) &= -4x^5 + 10x^4 - 2x^3 - x^2 - 4x + 2 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 5x^2 + 6x - 4$$

$$b(x) = 2x - 8$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$5x^2$	$6x$	-4
$2x$	$10x^3$	$12x^2$	$-8x$
-8	$-40x^2$	$-48x$	32

$$a(x) \cdot b(x) = 10x^3 + 12x^2 - 40x^2 - 8x - 48x + 32$$

Combine like terms.

$$a(x) \cdot b(x) = 10x^3 - 28x^2 - 56x + 32$$

3. Express $(x+1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 141)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -2x^3 - 15x^2 + 27x + 7 \\ g(x) &= x + 9 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+9}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & -2 & -15 & 27 & 7 \\ -9 & & 18 & -27 & 0 \\ \hline & -2 & 3 & 0 & 7 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -2x^2 + 3x + \frac{7}{x+9}$$

In other words, $h(x) = -2x^2 + 3x$ and the remainder is $R = 7$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -2x^3 - 15x^2 + 27x + 7$. Evaluate $f(-9)$.

You could do this the hard way.

$$\begin{aligned} f(-9) &= (-2)\cdot(-9)^3 \ + \ (-15)\cdot(-9)^2 \ + \ (27)\cdot(-9) \ + \ (7) \\ &= (-2)\cdot(-729) \ + \ (-15)\cdot(81) \ + \ (27)\cdot(-9) \ + \ (7) \\ &= (1458) \ + \ (-1215) \ + \ (-243) \ + \ (7) \\ &= 7 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-9)$ equals the remainder when $f(x)$ is divided by $x + 9$. Thus, $f(-9) = 7$.

Name: ____________________ Date: ____________________

Polynomial Operations SOLUTION (version 142)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -8x^5 - 3x^3 - 2x^2 + 6x + 7$$

$$q(x) = -6x^5 + 8x^4 - 5x^3 - 9x^2 + 1$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-8)x^5 + (0)x^4 + (-3)x^3 + (-2)x^2 + (6)x^1 + (7)x^0 \\ q(x) &= (-6)x^5 + (8)x^4 + (-5)x^3 + (-9)x^2 + (0)x^1 + (1)x^0 \\ q(x) - p(x) &= (2)x^5 + (8)x^4 + (-2)x^3 + (-7)x^2 + (-6)x^1 + (-6)x^0 \\ q(x) - p(x) &= 2x^5 + 8x^4 - 2x^3 - 7x^2 - 6x - 6 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -8x^2 + 3x - 5$$

$$b(x) = 7x - 5$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-8x^2$	$3x$	-5
$7x$	$-56x^3$	$21x^2$	$-35x$
-5	$40x^2$	$-15x$	25

$$a(x) \cdot b(x) = -56x^3 + 21x^2 + 40x^2 - 35x - 15x + 25$$

Combine like terms.

$$a(x) \cdot b(x) = -56x^3 + 61x^2 - 50x + 25$$

3. Express $(x+1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 142)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 10x^2 - 7x - 29 \\ g(x) &= x + 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 2 & 10 & -7 & -29 \\ -5 & & -10 & 0 & 35 \\ \hline & 2 & 0 & -7 & 6 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 - 7 + \frac{6}{x+5}$$

In other words, $h(x) = 2x^2 - 7$ and the remainder is $R = 6$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 10x^2 - 7x - 29$. Evaluate $f(-5)$.

You could do this the hard way.

$$\begin{aligned} f(-5) &= (2)\cdot(-5)^3 \ + \ (10)\cdot(-5)^2 \ + \ (-7)\cdot(-5) \ + \ (-29) \\ &= (2)\cdot(-125) \ + \ (10)\cdot(25) \ + \ (-7)\cdot(-5) \ + \ (-29) \\ &= (-250) \ + \ (250) \ + \ (35) \ + \ (-29) \\ &= 6 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-5)$ equals the remainder when $f(x)$ is divided by $x + 5$. Thus, $f(-5) = 6$.

Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 143)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 4x^5 - 8x^4 + x^3 - 10x^2 + 9$$
$$q(x) = -6x^5 + 3x^4 - 2x^2 - 8x - 7$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (4)x^5 + (-8)x^4 + (1)x^3 + (-10)x^2 + (0)x^1 + (9)x^0 \\ q(x) &= (-6)x^5 + (3)x^4 + (0)x^3 + (-2)x^2 + (-8)x^1 + (-7)x^0 \\ p(x) + q(x) &= (-2)x^5 + (-5)x^4 + (1)x^3 + (-12)x^2 + (-8)x^1 + (2)x^0 \\ p(x) + q(x) &= -2x^5 - 5x^4 + x^3 - 12x^2 - 8x + 2 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -2x^2 + 6x - 9$$
$$b(x) = -3x - 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-2x^2$	$6x$	-9
$-3x$	$6x^3$	$-18x^2$	$27x$
-4	$8x^2$	$-24x$	36

$$a(x) \cdot b(x) = 6x^3 - 18x^2 + 8x^2 + 27x - 24x + 36$$

Combine like terms.

$$a(x) \cdot b(x) = 6x^3 - 10x^2 + 3x + 36$$

3. Express $(x + 1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 143)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -3x^3 + 17x^2 - 10x + 4 \\ g(x) &= x - 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & -3 & 17 & -10 & 4 \\ 5 & & -15 & 10 & 0 \\ \hline & -3 & 2 & 0 & 4 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -3x^2 + 2x + \frac{4}{x-5}$$

In other words, $h(x) = -3x^2 + 2x$ and the remainder is $R = 4$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -3x^3 + 17x^2 - 10x + 4$. Evaluate $f(5)$.

You could do this the hard way.

$$\begin{aligned} f(5) &= (-3) \cdot (5)^3 \ + \ (17) \cdot (5)^2 \ + \ (-10) \cdot (5) \ + \ (4) \\ &= (-3) \cdot (125) \ + \ (17) \cdot (25) \ + \ (-10) \cdot (5) \ + \ (4) \\ &= (-375) \ + \ (425) \ + \ (-50) \ + \ (4) \\ &= 4 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(5)$ equals the remainder when $f(x)$ is divided by $x - 5$. Thus, $f(5) = 4$.

Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 144)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -8x^5 - x^4 + 3x^3 - 7x - 9$$

$$q(x) = -5x^5 - 7x^4 - 3x^3 + 10x^2 - 9$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (-8)x^5 + (-1)x^4 + (3)x^3 + (0)x^2 + (-7)x^1 + (-9)x^0 \\
q(x) &= (-5)x^5 + (-7)x^4 + (-3)x^3 + (10)x^2 + (0)x^1 + (-9)x^0 \\
p(x) - q(x) &= (-3)x^5 + (6)x^4 + (6)x^3 + (-10)x^2 + (-7)x^1 + (0)x^0 \\
p(x) - q(x) &= -3x^5 + 6x^4 + 6x^3 - 10x^2 - 7x
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 2x^2 - 6x - 5$$

$$b(x) = -6x + 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$2x^2$	$-6x$	-5
$-6x$	$-12x^3$	$36x^2$	$30x$
3	$6x^2$	$-18x$	-15

$$a(x) \cdot b(x) = -12x^3 + 36x^2 + 6x^2 + 30x - 18x - 15$$

Combine like terms.

$$a(x) \cdot b(x) = -12x^3 + 42x^2 + 12x - 15$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 144)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -2x^3 + 17x^2 + 11x - 28 \\ g(x) &= x - 9 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-9}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	-2	17	11	-28
9		-18	-9	18
	-2	-1	2	-10

So,

$$\frac{f(x)}{g(x)} = -2x^2 - x + 2 + \frac{-10}{x-9}$$

In other words, $h(x) = -2x^2 - x + 2$ and the remainder is $R = -10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -2x^3 + 17x^2 + 11x - 28$. Evaluate $f(9)$.

You could do this the hard way.

$$\begin{aligned} f(9) &= (-2)\cdot(9)^3 \;+\; (17)\cdot(9)^2 \;+\; (11)\cdot(9) \;+\; (-28) \\ &= (-2)\cdot(729) \;+\; (17)\cdot(81) \;+\; (11)\cdot(9) \;+\; (-28) \\ &= (-1458) \;+\; (1377) \;+\; (99) \;+\; (-28) \\ &= -10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(9)$ equals the remainder when $f(x)$ is divided by $x - 9$. Thus, $f(9) = -10$.

Name: ____________________ Date: ____________________

Polynomial Operations SOLUTION (version 145)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -4x^5 - x^4 - 5x^2 + 7x - 9$$

$$q(x) = 8x^5 - 6x^4 + 5x^3 - 2x^2 + 1$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-4)x^5 + (-1)x^4 + (0)x^3 + (-5)x^2 + (7)x^1 + (-9)x^0 \\ q(x) &= (8)x^5 + (-6)x^4 + (5)x^3 + (-2)x^2 + (0)x^1 + (1)x^0 \\ p(x) + q(x) &= (4)x^5 + (-7)x^4 + (5)x^3 + (-7)x^2 + (7)x^1 + (-8)x^0 \\ p(x) + q(x) &= 4x^5 - 7x^4 + 5x^3 - 7x^2 + 7x - 8 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 + 3x - 2$$

$$b(x) = -3x + 6$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$3x$	-2
$-3x$	$18x^3$	$-9x^2$	$6x$
6	$-36x^2$	$18x$	-12

$$a(x) \cdot b(x) = 18x^3 - 9x^2 - 36x^2 + 6x + 18x - 12$$

Combine like terms.

$$a(x) \cdot b(x) = 18x^3 - 45x^2 + 24x - 12$$

3. Express $(x+1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 145)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 17x^2 + 11x + 21 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 2 & 17 & 11 & 21 \\ \text{-8} & & \text{-16} & \text{-8} & \text{-24} \\ \hline & 2 & 1 & 3 & \text{-3} \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 + x + 3 + \frac{-3}{x+8}$$

In other words, $h(x) = 2x^2 + x + 3$ and the remainder is $R = -3$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 17x^2 + 11x + 21$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (2)\cdot(-8)^3 \ + \ (17)\cdot(-8)^2 \ + \ (11)\cdot(-8) \ + \ (21) \\ &= (2)\cdot(-512) \ + \ (17)\cdot(64) \ + \ (11)\cdot(-8) \ + \ (21) \\ &= (-1024) \ + \ (1088) \ + \ (-88) \ + \ (21) \\ &= -3 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x + 8$. Thus, $f(-8) = -3$.

Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 146)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 8x^5 + 4x^4 + 10x^3 - 3x^2 + 5$$

$$q(x) = 10x^5 - 4x^4 + x^2 - 9x - 8$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (8)x^5 + (4)x^4 + (10)x^3 + (-3)x^2 + (0)x^1 + (5)x^0 \\ q(x) &= (10)x^5 + (-4)x^4 + (0)x^3 + (1)x^2 + (-9)x^1 + (-8)x^0 \\ p(x) + q(x) &= (18)x^5 + (0)x^4 + (10)x^3 + (-2)x^2 + (-9)x^1 + (-3)x^0 \\ p(x) + q(x) &= 18x^5 + 10x^3 - 2x^2 - 9x - 3 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 4x^2 - 6x + 5$$

$$b(x) = -7x - 9$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$4x^2$	$-6x$	5
$-7x$	$-28x^3$	$42x^2$	$-35x$
-9	$-36x^2$	$54x$	-45

$$a(x) \cdot b(x) = -28x^3 + 42x^2 - 36x^2 - 35x + 54x - 45$$

Combine like terms.

$$a(x) \cdot b(x) = -28x^3 + 6x^2 + 19x - 45$$

3. Express $(x + 1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 146)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= x^3 - 6x^2 - 26x - 6 \\ g(x) &= x - 9 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-9}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & 1 & -6 & -26 & -6 \\ 9 & & 9 & 27 & 9 \\ \hline & 1 & 3 & 1 & 3 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = x^2 + 3x + 1 + \frac{3}{x-9}$$

In other words, $h(x) = x^2 + 3x + 1$ and the remainder is $R = 3$.

5. Let polynomial $f(x)$ still be defined as $f(x) = x^3 - 6x^2 - 26x - 6$. Evaluate $f(9)$.

You could do this the hard way.

$$\begin{aligned} f(9) &= (1)\cdot(9)^3 \ + \ (-6)\cdot(9)^2 \ + \ (-26)\cdot(9) \ + \ (-6) \\ &= (1)\cdot(729) \ + \ (-6)\cdot(81) \ + \ (-26)\cdot(9) \ + \ (-6) \\ &= (729) \ + \ (-486) \ + \ (-234) \ + \ (-6) \\ &= 3 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(9)$ equals the remainder when $f(x)$ is divided by $x - 9$. Thus, $f(9) = 3$.

Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 147)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -2x^5 + 9x^3 - 3x^2 - 6x + 7$$

$$q(x) = 7x^5 - x^4 - 2x^3 + 6x - 4$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (-2)x^5 + (0)x^4 + (9)x^3 + (-3)x^2 + (-6)x^1 + (7)x^0 \\
q(x) &= (7)x^5 + (-1)x^4 + (-2)x^3 + (0)x^2 + (6)x^1 + (-4)x^0 \\
p(x) - q(x) &= (-9)x^5 + (1)x^4 + (11)x^3 + (-3)x^2 + (-12)x^1 + (11)x^0 \\
p(x) - q(x) &= -9x^5 + x^4 + 11x^3 - 3x^2 - 12x + 11
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 - 5x - 7$$

$$b(x) = -2x - 9$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$-5x$	-7
$-2x$	$12x^3$	$10x^2$	$14x$
-9	$54x^2$	$45x$	63

$$a(x) \cdot b(x) = 12x^3 + 10x^2 + 54x^2 + 14x + 45x + 63$$

Combine like terms.

$$a(x) \cdot b(x) = 12x^3 + 64x^2 + 59x + 63$$

3. Express $(x + 1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 147)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -3x^3 - 23x^2 + 6x - 10 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	-3	-23	6	-10
-8		24	-8	16
	-3	1	-2	6

So,

$$\frac{f(x)}{g(x)} = -3x^2 + x - 2 + \frac{6}{x+8}$$

In other words, $h(x) = -3x^2 + x - 2$ and the remainder is $R = 6$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -3x^3 - 23x^2 + 6x - 10$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (-3)\cdot(-8)^3 \;+\; (-23)\cdot(-8)^2 \;+\; (6)\cdot(-8) \;+\; (-10) \\ &= (-3)\cdot(-512) \;+\; (-23)\cdot(64) \;+\; (6)\cdot(-8) \;+\; (-10) \\ &= (1536) \;+\; (-1472) \;+\; (-48) \;+\; (-10) \\ &= 6 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x+8$. Thus, $f(-8) = 6$.

Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 148)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$\begin{aligned} p(x) &= 3x^5 - x^4 + 2x^3 - 6x - 5 \\ q(x) &= 8x^5 - 3x^3 - 5x^2 - 2x - 9 \end{aligned}$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (3)x^5 + (-1)x^4 + (2)x^3 + (0)x^2 + (-6)x^1 + (-5)x^0 \\ q(x) &= (8)x^5 + (0)x^4 + (-3)x^3 + (-5)x^2 + (-2)x^1 + (-9)x^0 \\ q(x) - p(x) &= (5)x^5 + (1)x^4 + (-5)x^3 + (-5)x^2 + (4)x^1 + (-4)x^0 \\ q(x) - p(x) &= 5x^5 + x^4 - 5x^3 - 5x^2 + 4x - 4 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$\begin{aligned} a(x) &= 2x^2 + 7x + 6 \\ b(x) &= 7x - 9 \end{aligned}$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$2x^2$	$7x$	6
$7x$	$14x^3$	$49x^2$	$42x$
-9	$-18x^2$	$-63x$	-54

$$a(x) \cdot b(x) = 14x^3 + 49x^2 - 18x^2 + 42x - 63x - 54$$

Combine like terms.

$$a(x) \cdot b(x) = 14x^3 + 31x^2 - 21x - 54$$

3. Express $(x+1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 148)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 4x^3 - 29x^2 + 4x + 26 \\ g(x) &= x - 7 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-7}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 4 & -29 & 4 & 26 \\ 7 & & 28 & -7 & -21 \\ \hline & 4 & -1 & -3 & 5 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 4x^2 - x - 3 + \frac{5}{x-7}$$

In other words, $h(x) = 4x^2 - x - 3$ and the remainder is $R = 5$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 4x^3 - 29x^2 + 4x + 26$. Evaluate $f(7)$.

You could do this the hard way.

$$\begin{aligned} f(7) &= (4)\cdot(7)^3 \;+\; (-29)\cdot(7)^2 \;+\; (4)\cdot(7) \;+\; (26) \\ &= (4)\cdot(343) \;+\; (-29)\cdot(49) \;+\; (4)\cdot(7) \;+\; (26) \\ &= (1372) \;+\; (-1421) \;+\; (28) \;+\; (26) \\ &= 5 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(7)$ equals the remainder when $f(x)$ is divided by $x - 7$. Thus, $f(7) = 5$.

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Polynomial Operations SOLUTION (version 149)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -7x^5 + 8x^4 + 4x^3 - 9x^2 - 3$$

$$q(x) = -6x^5 - 3x^4 - x^2 + 8x + 7$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-7)x^5 + (8)x^4 + (4)x^3 + (-9)x^2 + (0)x^1 + (-3)x^0 \\ q(x) &= (-6)x^5 + (-3)x^4 + (0)x^3 + (-1)x^2 + (8)x^1 + (7)x^0 \\ p(x) - q(x) &= (-1)x^5 + (11)x^4 + (4)x^3 + (-8)x^2 + (-8)x^1 + (-10)x^0 \\ p(x) - q(x) &= -x^5 + 11x^4 + 4x^3 - 8x^2 - 8x - 10 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -9x^2 + 3x + 2$$

$$b(x) = 7x + 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-9x^2$	$3x$	2
$7x$	$-63x^3$	$21x^2$	$14x$
4	$-36x^2$	$12x$	8

$$a(x) \cdot b(x) = -63x^3 + 21x^2 - 36x^2 + 14x + 12x + 8$$

Combine like terms.

$$a(x) \cdot b(x) = -63x^3 - 15x^2 + 26x + 8$$

3. Express $(x + 1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 149)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= x^3 + 6x^2 - 12x + 27 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 1 & 6 & -12 & 27 \\ -8 & & -8 & 16 & -32 \\ \hline & 1 & -2 & 4 & -5 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = x^2 - 2x + 4 + \frac{-5}{x+8}$$

In other words, $h(x) = x^2 - 2x + 4$ and the remainder is $R = -5$.

5. Let polynomial $f(x)$ still be defined as $f(x) = x^3 + 6x^2 - 12x + 27$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (1)\cdot(-8)^3 \ + \ (6)\cdot(-8)^2 \ + \ (-12)\cdot(-8) \ + \ (27) \\ &= (1)\cdot(-512) \ + \ (6)\cdot(64) \ + \ (-12)\cdot(-8) \ + \ (27) \\ &= (-512) \ + \ (384) \ + \ (96) \ + \ (27) \\ &= -5 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x + 8$. Thus, $f(-8) = -5$.

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Polynomial Operations SOLUTION (version 150)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 3x^5 - x^4 - 10x^3 - 5x + 6$$

$$q(x) = -2x^5 + 7x^4 + 9x^2 + x + 5$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$p(x) = (3)x^5 + (-1)x^4 + (-10)x^3 + (0)x^2 + (-5)x^1 + (6)x^0$$
$$q(x) = (-2)x^5 + (7)x^4 + (0)x^3 + (9)x^2 + (1)x^1 + (5)x^0$$
$$p(x) + q(x) = (1)x^5 + (6)x^4 + (-10)x^3 + (9)x^2 + (-4)x^1 + (11)x^0$$
$$p(x) + q(x) = x^5 + 6x^4 - 10x^3 + 9x^2 - 4x + 11$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 + 7x + 5$$

$$b(x) = 3x + 7$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$7x$	5
$3x$	$-18x^3$	$21x^2$	$15x$
7	$-42x^2$	$49x$	35

$$a(x) \cdot b(x) = -18x^3 + 21x^2 - 42x^2 + 15x + 49x + 35$$

Combine like terms.

$$a(x) \cdot b(x) = -18x^3 - 21x^2 + 64x + 35$$

3. Express $(x + 1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 150)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= x^3 - 2x^2 - 26x + 22 \\ g(x) &= x - 6 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-6}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 1 & -2 & -26 & 22 \\ 6 & & 6 & 24 & -12 \\ \hline & 1 & 4 & -2 & 10 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = x^2 + 4x - 2 + \frac{10}{x-6}$$

In other words, $h(x) = x^2 + 4x - 2$ and the remainder is $R = 10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = x^3 - 2x^2 - 26x + 22$. Evaluate $f(6)$.

You could do this the hard way.

$$\begin{aligned} f(6) &= (1)\cdot(6)^3 \ + \ (-2)\cdot(6)^2 \ + \ (-26)\cdot(6) \ + \ (22) \\ &= (1)\cdot(216) \ + \ (-2)\cdot(36) \ + \ (-26)\cdot(6) \ + \ (22) \\ &= (216) \ + \ (-72) \ + \ (-156) \ + \ (22) \\ &= 10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(6)$ equals the remainder when $f(x)$ is divided by $x - 6$. Thus, $f(6) = 10$.

Name: ____________________ Date: ____________________

Polynomial Operations SOLUTION (version 151)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -x^5 + 4x^4 + 8x^2 - 3x + 10$$

$$q(x) = 2x^5 - 6x^3 - 5x^2 + 4x + 1$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-1)x^5 + (4)x^4 + (0)x^3 + (8)x^2 + (-3)x^1 + (10)x^0 \\ q(x) &= (2)x^5 + (0)x^4 + (-6)x^3 + (-5)x^2 + (4)x^1 + (1)x^0 \\ p(x) + q(x) &= (1)x^5 + (4)x^4 + (-6)x^3 + (3)x^2 + (1)x^1 + (11)x^0 \\ p(x) + q(x) &= x^5 + 4x^4 - 6x^3 + 3x^2 + x + 11 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 7x^2 + 5x + 4$$

$$b(x) = 3x - 5$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$7x^2$	$5x$	4
$3x$	$21x^3$	$15x^2$	$12x$
-5	$-35x^2$	$-25x$	-20

$$a(x) \cdot b(x) = 21x^3 + 15x^2 - 35x^2 + 12x - 25x - 20$$

Combine like terms.

$$a(x) \cdot b(x) = 21x^3 - 20x^2 - 13x - 20$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 151)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -2x^3 + 15x^2 - 6x + 1 \\ g(x) &= x - 7 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-7}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & -2 & 15 & -6 & 1 \\ 7 & & -14 & 7 & 7 \\ \hline & -2 & 1 & 1 & 8 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -2x^2 + x + 1 + \frac{8}{x-7}$$

In other words, $h(x) = -2x^2 + x + 1$ and the remainder is $R = 8$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -2x^3 + 15x^2 - 6x + 1$. Evaluate $f(7)$.

You could do this the hard way.

$$\begin{aligned} f(7) &= (-2)\cdot(7)^3 \ + \ (15)\cdot(7)^2 \ + \ (-6)\cdot(7) \ + \ (1) \\ &= (-2)\cdot(343) \ + \ (15)\cdot(49) \ + \ (-6)\cdot(7) \ + \ (1) \\ &= (-686) \ + \ (735) \ + \ (-42) \ + \ (1) \\ &= 8 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(7)$ equals the remainder when $f(x)$ is divided by $x - 7$. Thus, $f(7) = 8$.

Name: ______________________ Date: ______________

Polynomial Operations SOLUTION (version 152)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -9x^5 - 4x^3 - x^2 - 2x + 7$$

$$q(x) = 7x^5 - 2x^4 + x^2 + 8x + 3$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-9)x^5 + (0)x^4 + (-4)x^3 + (-1)x^2 + (-2)x^1 + (7)x^0 \\ q(x) &= (7)x^5 + (-2)x^4 + (0)x^3 + (1)x^2 + (8)x^1 + (3)x^0 \\ q(x) - p(x) &= (16)x^5 + (-2)x^4 + (4)x^3 + (2)x^2 + (10)x^1 + (-4)x^0 \\ q(x) - p(x) &= 16x^5 - 2x^4 + 4x^3 + 2x^2 + 10x - 4 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -3x^2 - 2x + 4$$

$$b(x) = -3x + 8$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-3x^2$	$-2x$	4
$-3x$	$9x^3$	$6x^2$	$-12x$
8	$-24x^2$	$-16x$	32

$$a(x) \cdot b(x) = 9x^3 + 6x^2 - 24x^2 - 12x - 16x + 32$$

Combine like terms.

$$a(x) \cdot b(x) = 9x^3 - 18x^2 - 28x + 32$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 152)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 15x^2 + 19x - 29 \\ g(x) &= x + 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	2	15	19	-29
-5		-10	-25	30
	2	5	-6	1

So,

$$\frac{f(x)}{g(x)} = 2x^2 + 5x - 6 + \frac{1}{x+5}$$

In other words, $h(x) = 2x^2 + 5x - 6$ and the remainder is $R = 1$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 15x^2 + 19x - 29$. Evaluate $f(-5)$.

You could do this the hard way.

$$\begin{aligned} f(-5) &= (2)\cdot(-5)^3 \ + \ (15)\cdot(-5)^2 \ + \ (19)\cdot(-5) \ + \ (-29) \\ &= (2)\cdot(-125) \ + \ (15)\cdot(25) \ + \ (19)\cdot(-5) \ + \ (-29) \\ &= (-250) \ + \ (375) \ + \ (-95) \ + \ (-29) \\ &= 1 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-5)$ equals the remainder when $f(x)$ is divided by $x+5$. Thus, $f(-5) = 1$.

Name: Date:

Polynomial Operations SOLUTION (version 153)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 3x^5 - 8x^4 - 9x^3 - 5x - 10$$

$$q(x) = 9x^5 - 10x^4 - 8x^2 - x - 2$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (3)x^5 + (-8)x^4 + (-9)x^3 + (0)x^2 + (-5)x^1 + (-10)x^0 \\ q(x) &= (9)x^5 + (-10)x^4 + (0)x^3 + (-8)x^2 + (-1)x^1 + (-2)x^0 \\ p(x) - q(x) &= (-6)x^5 + (2)x^4 + (-9)x^3 + (8)x^2 + (-4)x^1 + (-8)x^0 \\ p(x) - q(x) &= -6x^5 + 2x^4 - 9x^3 + 8x^2 - 4x - 8 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 - 9x - 3$$

$$b(x) = -5x + 2$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$-9x$	-3
$-5x$	$30x^3$	$45x^2$	$15x$
2	$-12x^2$	$-18x$	-6

$$a(x) \cdot b(x) = 30x^3 + 45x^2 - 12x^2 + 15x - 18x - 6$$

Combine like terms.

$$a(x) \cdot b(x) = 30x^3 + 33x^2 - 3x - 6$$

3. Express $(x+1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 153)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= x^3 - 11x^2 + 28x + 4 \\ g(x) &= x - 7 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-7}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 1 & -11 & 28 & 4 \\ 7 & & 7 & -28 & 0 \\ \hline & 1 & -4 & 0 & 4 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = x^2 - 4x + \frac{4}{x-7}$$

In other words, $h(x) = x^2 - 4x$ and the remainder is $R = 4$.

5. Let polynomial $f(x)$ still be defined as $f(x) = x^3 - 11x^2 + 28x + 4$. Evaluate $f(7)$.

You could do this the hard way.

$$\begin{aligned} f(7) &= (1)\cdot(7)^3 \ + \ (-11)\cdot(7)^2 \ + \ (28)\cdot(7) \ + \ (4) \\ &= (1)\cdot(343) \ + \ (-11)\cdot(49) \ + \ (28)\cdot(7) \ + \ (4) \\ &= (343) \ + \ (-539) \ + \ (196) \ + \ (4) \\ &= 4 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(7)$ equals the remainder when $f(x)$ is divided by $x - 7$. Thus, $f(7) = 4$.

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Polynomial Operations SOLUTION (version 154)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -4x^5 - 8x^4 - x^3 + 3x^2 + 9$$

$$q(x) = x^5 + 4x^4 + 6x^2 + 2x + 3$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-4)x^5 + (-8)x^4 + (-1)x^3 + (3)x^2 + (0)x^1 + (9)x^0 \\ q(x) &= (1)x^5 + (4)x^4 + (0)x^3 + (6)x^2 + (2)x^1 + (3)x^0 \\ p(x) - q(x) &= (-5)x^5 + (-12)x^4 + (-1)x^3 + (-3)x^2 + (-2)x^1 + (6)x^0 \\ p(x) - q(x) &= -5x^5 - 12x^4 - x^3 - 3x^2 - 2x + 6 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 - 7x + 5$$

$$b(x) = 2x - 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$-7x$	5
$2x$	$-12x^3$	$-14x^2$	$10x$
-3	$18x^2$	$21x$	-15

$$a(x) \cdot b(x) = -12x^3 - 14x^2 + 18x^2 + 10x + 21x - 15$$

Combine like terms.

$$a(x) \cdot b(x) = -12x^3 + 4x^2 + 31x - 15$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 154)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 4x^3 + 24x^2 - 3x - 15 \\ g(x) &= x + 6 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+6}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 4 & 24 & -3 & -15 \\ -6 & & -24 & 0 & 18 \\ \hline & 4 & 0 & -3 & 3 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 4x^2 - 3 + \frac{3}{x+6}$$

In other words, $h(x) = 4x^2 - 3$ and the remainder is $R = 3$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 4x^3 + 24x^2 - 3x - 15$. Evaluate $f(-6)$.

You could do this the hard way.

$$\begin{aligned} f(-6) &= (4)\cdot(-6)^3 \ + \ (24)\cdot(-6)^2 \ + \ (-3)\cdot(-6) \ + \ (-15) \\ &= (4)\cdot(-216) \ + \ (24)\cdot(36) \ + \ (-3)\cdot(-6) \ + \ (-15) \\ &= (-864) \ + \ (864) \ + \ (18) \ + \ (-15) \\ &= 3 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-6)$ equals the remainder when $f(x)$ is divided by $x+6$. Thus, $f(-6) = 3$.

Name: ____________________ Date: ____________

Polynomial Operations SOLUTION (version 155)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 10x^5 + 9x^4 - x^2 + 4x + 6$$

$$q(x) = -8x^5 - 7x^4 - 3x^3 + 5x^2 + 2$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (10)x^5 + (9)x^4 + (0)x^3 + (-1)x^2 + (4)x^1 + (6)x^0 \\
q(x) &= (-8)x^5 + (-7)x^4 + (-3)x^3 + (5)x^2 + (0)x^1 + (2)x^0 \\
q(x) - p(x) &= (-18)x^5 + (-16)x^4 + (-3)x^3 + (6)x^2 + (-4)x^1 + (-4)x^0 \\
q(x) - p(x) &= -18x^5 - 16x^4 - 3x^3 + 6x^2 - 4x - 4
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 + 3x - 7$$

$$b(x) = 8x - 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$3x$	-7
$8x$	$-48x^3$	$24x^2$	$-56x$
-4	$24x^2$	$-12x$	28

$$a(x) \cdot b(x) = -48x^3 + 24x^2 + 24x^2 - 56x - 12x + 28$$

Combine like terms.

$$a(x) \cdot b(x) = -48x^3 + 48x^2 - 68x + 28$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 155)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 14x^2 + 24x + 24 \\ g(x) &= x + 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	2	14	24	24
-5		-10	-20	-20
	2	4	4	4

So,

$$\frac{f(x)}{g(x)} = 2x^2 + 4x + 4 + \frac{4}{x+5}$$

In other words, $h(x) = 2x^2 + 4x + 4$ and the remainder is $R = 4$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 14x^2 + 24x + 24$. Evaluate $f(-5)$.

You could do this the hard way.

$$\begin{aligned} f(-5) &= (2)\cdot(-5)^3 \; + \; (14)\cdot(-5)^2 \; + \; (24)\cdot(-5) \; + \; (24) \\ &= (2)\cdot(-125) \; + \; (14)\cdot(25) \; + \; (24)\cdot(-5) \; + \; (24) \\ &= (-250) \; + \; (350) \; + \; (-120) \; + \; (24) \\ &= 4 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-5)$ equals the remainder when $f(x)$ is divided by $x+5$. Thus, $f(-5) = 4$.

Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 156)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 5x^5 + 4x^4 + 3x^3 + 10x^2 + 8$$
$$q(x) = 9x^5 - 8x^4 + 4x^3 - 10x - 5$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (5)x^5 + (4)x^4 + (3)x^3 + (10)x^2 + (0)x^1 + (8)x^0 \\ q(x) &= (9)x^5 + (-8)x^4 + (4)x^3 + (0)x^2 + (-10)x^1 + (-5)x^0 \\ p(x) - q(x) &= (-4)x^5 + (12)x^4 + (-1)x^3 + (10)x^2 + (10)x^1 + (13)x^0 \\ p(x) - q(x) &= -4x^5 + 12x^4 - x^3 + 10x^2 + 10x + 13 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -4x^2 - 5x - 7$$
$$b(x) = 3x + 8$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-4x^2$	$-5x$	-7
$3x$	$-12x^3$	$-15x^2$	$-21x$
8	$-32x^2$	$-40x$	-56

$$a(x) \cdot b(x) = -12x^3 - 15x^2 - 32x^2 - 21x - 40x - 56$$

Combine like terms.

$$a(x) \cdot b(x) = -12x^3 - 47x^2 - 61x - 56$$

3. Express $(x+1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 156)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 5x^3 - 25x^2 - 4x + 22 \\ g(x) &= x - 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 5 & -25 & -4 & 22 \\ 5 & & 25 & 0 & -20 \\ \hline & 5 & 0 & -4 & 2 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 5x^2 - 4 + \frac{2}{x-5}$$

In other words, $h(x) = 5x^2 - 4$ and the remainder is $R = 2$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 5x^3 - 25x^2 - 4x + 22$. Evaluate $f(5)$.

You could do this the hard way.

$$\begin{aligned} f(5) &= (5)\cdot(5)^3 \ + \ (-25)\cdot(5)^2 \ + \ (-4)\cdot(5) \ + \ (22) \\ &= (5)\cdot(125) \ + \ (-25)\cdot(25) \ + \ (-4)\cdot(5) \ + \ (22) \\ &= (625) \ + \ (-625) \ + \ (-20) \ + \ (22) \\ &= 2 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(5)$ equals the remainder when $f(x)$ is divided by $x - 5$. Thus, $f(5) = 2$.

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Polynomial Operations SOLUTION (version 157)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -8x^5 - 10x^3 - 7x^2 + x + 2$$

$$q(x) = 3x^5 + 5x^4 - 10x^2 + 2x - 7$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (-8)x^5 + (0)x^4 + (-10)x^3 + (-7)x^2 + (1)x^1 + (2)x^0 \\
q(x) &= (3)x^5 + (5)x^4 + (0)x^3 + (-10)x^2 + (2)x^1 + (-7)x^0 \\
p(x) - q(x) &= (-11)x^5 + (-5)x^4 + (-10)x^3 + (3)x^2 + (-1)x^1 + (9)x^0 \\
p(x) - q(x) &= -11x^5 - 5x^4 - 10x^3 + 3x^2 - x + 9
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 9x^2 - 4x - 5$$

$$b(x) = 2x - 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$9x^2$	$-4x$	-5
$2x$	$18x^3$	$-8x^2$	$-10x$
-3	$-27x^2$	$12x$	15

$$a(x) \cdot b(x) = 18x^3 - 8x^2 - 27x^2 - 10x + 12x + 15$$

Combine like terms.

$$a(x) \cdot b(x) = 18x^3 - 35x^2 + 2x + 15$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 157)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -5x^3 + 18x^2 + 13x - 25 \\ g(x) &= x - 4 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-4}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & -5 & 18 & 13 & -25 \\ 4 & & -20 & -8 & 20 \\ \hline & -5 & -2 & 5 & -5 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -5x^2 - 2x + 5 + \frac{-5}{x-4}$$

In other words, $h(x) = -5x^2 - 2x + 5$ and the remainder is $R = -5$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -5x^3 + 18x^2 + 13x - 25$. Evaluate $f(4)$.

You could do this the hard way.

$$\begin{aligned} f(4) &= (-5)\cdot(4)^3 + (18)\cdot(4)^2 + (13)\cdot(4) + (-25) \\ &= (-5)\cdot(64) + (18)\cdot(16) + (13)\cdot(4) + (-25) \\ &= (-320) + (288) + (52) + (-25) \\ &= -5 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(4)$ equals the remainder when $f(x)$ is divided by $x - 4$. Thus, $f(4) = -5$.

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Polynomial Operations SOLUTION (version 158)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 8x^5 - 6x^3 + 9x^2 - 4x - 10$$

$$q(x) = 4x^5 + 10x^4 - 7x^3 + 6x - 9$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (8)x^5 + (0)x^4 + (-6)x^3 + (9)x^2 + (-4)x^1 + (-10)x^0 \\
q(x) &= (4)x^5 + (10)x^4 + (-7)x^3 + (0)x^2 + (6)x^1 + (-9)x^0 \\
p(x) + q(x) &= (12)x^5 + (10)x^4 + (-13)x^3 + (9)x^2 + (2)x^1 + (-19)x^0 \\
p(x) + q(x) &= 12x^5 + 10x^4 - 13x^3 + 9x^2 + 2x - 19
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 6x^2 + 3x - 7$$

$$b(x) = 5x + 9$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$6x^2$	$3x$	-7
$5x$	$30x^3$	$15x^2$	$-35x$
9	$54x^2$	$27x$	-63

$$a(x) \cdot b(x) = 30x^3 + 15x^2 + 54x^2 - 35x + 27x - 63$$

Combine like terms.

$$a(x) \cdot b(x) = 30x^3 + 69x^2 - 8x - 63$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 158)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 - 7x^2 - 15x - 10 \\ g(x) &= x - 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & 2 & -7 & -15 & -10 \\ 5 & & 10 & 15 & 0 \\ \hline & 2 & 3 & 0 & -10 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 + 3x + \frac{-10}{x-5}$$

In other words, $h(x) = 2x^2 + 3x$ and the remainder is $R = -10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 - 7x^2 - 15x - 10$. Evaluate $f(5)$.

You could do this the hard way.

$$\begin{aligned} f(5) &= (2)\cdot(5)^3 \ + \ (-7)\cdot(5)^2 \ + \ (-15)\cdot(5) \ + \ (-10) \\ &= (2)\cdot(125) \ + \ (-7)\cdot(25) \ + \ (-15)\cdot(5) \ + \ (-10) \\ &= (250) \ + \ (-175) \ + \ (-75) \ + \ (-10) \\ &= -10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(5)$ equals the remainder when $f(x)$ is divided by $x - 5$. Thus, $f(5) = -10$.

Name: ____ Date: ____________________

Polynomial Operations SOLUTION (version 159)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -8x^5 - 10x^4 - 9x^3 + 7x + 1$$

$$q(x) = 10x^5 + 2x^4 - 3x^3 + 4x^2 - 7$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-8)x^5 + (-10)x^4 + (-9)x^3 + (0)x^2 + (7)x^1 + (1)x^0 \\ q(x) &= (10)x^5 + (2)x^4 + (-3)x^3 + (4)x^2 + (0)x^1 + (-7)x^0 \\ p(x) - q(x) &= (-18)x^5 + (-12)x^4 + (-6)x^3 + (-4)x^2 + (7)x^1 + (8)x^0 \\ p(x) - q(x) &= -18x^5 - 12x^4 - 6x^3 - 4x^2 + 7x + 8 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 7x^2 - 6x - 3$$

$$b(x) = -7x + 2$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$7x^2$	$-6x$	-3
$-7x$	$-49x^3$	$42x^2$	$21x$
2	$14x^2$	$-12x$	-6

$$a(x) \cdot b(x) = -49x^3 + 42x^2 + 14x^2 + 21x - 12x - 6$$

Combine like terms.

$$a(x) \cdot b(x) = -49x^3 + 56x^2 + 9x - 6$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 159)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 17x^2 + 10x + 14 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 2 & 17 & 10 & 14 \\ -8 & & -16 & -8 & -16 \\ \hline & 2 & 1 & 2 & -2 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 + x + 2 + \frac{-2}{x+8}$$

In other words, $h(x) = 2x^2 + x + 2$ and the remainder is $R = -2$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 17x^2 + 10x + 14$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (2)\cdot(-8)^3 \;+\; (17)\cdot(-8)^2 \;+\; (10)\cdot(-8) \;+\; (14) \\ &= (2)\cdot(-512) \;+\; (17)\cdot(64) \;+\; (10)\cdot(-8) \;+\; (14) \\ &= (-1024) \;+\; (1088) \;+\; (-80) \;+\; (14) \\ &= -2 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x + 8$. Thus, $f(-8) = -2$.

Name: ____________________ Date: ____________________

Polynomial Operations SOLUTION (version 160)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -9x^5 + 3x^4 + 7x^2 - x + 2$$

$$q(x) = 4x^5 + 7x^3 - 8x^2 - x + 10$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-9)x^5 + (3)x^4 + (0)x^3 + (7)x^2 + (-1)x^1 + (2)x^0 \\ q(x) &= (4)x^5 + (0)x^4 + (7)x^3 + (-8)x^2 + (-1)x^1 + (10)x^0 \\ p(x) - q(x) &= (-13)x^5 + (3)x^4 + (-7)x^3 + (15)x^2 + (0)x^1 + (-8)x^0 \\ p(x) - q(x) &= -13x^5 + 3x^4 - 7x^3 + 15x^2 - 8 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -9x^2 - 6x - 4$$

$$b(x) = -7x - 2$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-9x^2$	$-6x$	-4
$-7x$	$63x^3$	$42x^2$	$28x$
-2	$18x^2$	$12x$	8

$$a(x) \cdot b(x) = 63x^3 + 42x^2 + 18x^2 + 28x + 12x + 8$$

Combine like terms.

$$a(x) \cdot b(x) = 63x^3 + 60x^2 + 40x + 8$$

3. Express $(x+1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 160)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -2x^3 + 20x^2 - 28x - 28 \\ g(x) &= x - 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & -2 & 20 & -28 & -28 \\ 8 & & -16 & 32 & 32 \\ \hline & -2 & 4 & 4 & 4 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -2x^2 + 4x + 4 + \frac{4}{x-8}$$

In other words, $h(x) = -2x^2 + 4x + 4$ and the remainder is $R = 4$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -2x^3 + 20x^2 - 28x - 28$. Evaluate $f(8)$.

You could do this the hard way.

$$\begin{aligned} f(8) &= (-2)\cdot(8)^3 \ + \ (20)\cdot(8)^2 \ + \ (-28)\cdot(8) \ + \ (-28) \\ &= (-2)\cdot(512) \ + \ (20)\cdot(64) \ + \ (-28)\cdot(8) \ + \ (-28) \\ &= (-1024) \ + \ (1280) \ + \ (-224) \ + \ (-28) \\ &= 4 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(8)$ equals the remainder when $f(x)$ is divided by $x - 8$. Thus, $f(8) = 4$.